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ABSTRACT

The five-phased plan of action developed by personnel at Kent State has delineated an overall structure of teacher education redesign. Present costs can be computed for each graduating student. Implementation of the new guidelines for teacher education based on emerging needs will change the costs of teacher preparation. The purpose of this evaluation research has been to analyze the changes in costs between the existing program and the new program outlined by the Kent State University Redesign Committee which is based on the STANDARDS FOR COLLEGES OR UNIVERSITIES PREPARING TEACHERS. (Author/LH)

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A Cost Analysis Study of Ohio Redesign of Teacher Education

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When changes of the magnitude suggested by the redesign of teacher education in Ohio are implemented in an institution the size of Kent State University, justifiable questions regarding the costs of these changes are raised. The five-phased plan of action developed by personnel at Kent State University has delineated an overall structure of teacher education redesign. The new structure incorporates some components of the existing educational program. For the most part, however, significant modifications in the current procedures for teacher education are necessary in 36 certification areas. These modifications will result in certain costs. For the present teacher education program, the costs associated with the education of each graduate can be calculated. Implementation of new guidelines for teacher education based on emerging needs will change the costs of teacher preparation. The purpose of this evaluation research has been to analyze the changes in costs between the existing program and the program outlined by the Kent State University Redesign Committee which is based on the Standards for Colleges or Universities Preparing Teachers.

The Problem

Cost studies have been conducted in the United States for most of this century. Their application to education generally and teacher education more specifically is a more recent phenomenon (e.g., Cage and Manatt, 1969; Topping, 1972). Current use of cost concepts in education created some definitional problems (Manning, 1968) and problems were created by the use of new terms (Fisher, 1972). Wilkinson (1972) has developed a classification system that provides standard definitions for cost techniques. In this study the following definition of cost-benefit analysis has been used:

> Cost-benefit analysis involves the comparison of all the relevant resources (such as dollar value of personnel, equipment, etc.) required to achieve an objective with the likely benefits (dollar value results) to be obtained from achievement of the objective in order to aid in managerial decisions as to the desirability of initiating or continuing a program in light of long-range time and social considerations (Wilkinson, 1972, p. 34).

To conduct this study based on the above definition of cost-benefit analysis, it has been necessary to reduce benefits and costs to monetary values (Peters, 1968). There is neither a model available in the field of teacher education nor a process that can be used to translate benefits and costs into monetary values. The lack of such a model is the problem addressed by this study.

The nature of the cost concept is many faceted. Traditionally, cost accounting has dealt with two cost categories--direct costs and indirect costs (Research Resources, 1974). Direct costs include items such as salaries of teaching personnel. Indirect costs include maintenance expenses and lighting. A third set of costs can be associated with amortization of physical plants, i.e., depreciation and interest rates. A fourth category is particularly relevant for a cost-benefit analysis of the redesign of teacher education. This concerns the area of spillover costs (Judy, 1969). These costs are a direct result of the program, but they are not supported by the teacher education institution. For example, if a school district appoints a person to be responsible

for coordinating field experiences, then the cost is borne by the district not the institution of higher education. Yet, these are costs of the program. Finally, time has been identified as a variable in cost analysis (Kite and Steckler, 1974).

The degree of specificity in the literature dealing with the cost concept has not been duplicated for the benefit concept. Benefits are usually considered outcomes or products of a system's operation. For a successful cost study, the "product" must be defined; its make-up identified (Wohlferd, 1970). One author describes the product as an "output-distribution configuration" (Rothenberg, 1975). Benefits can be identified. A problem exists, however, when trying to operationalize benefits in teacher education (e.g., achievement gain scores of students) and when attaching a dollar value to the benefits.

The precision of some conceptualizations of both costs and benefits may be unrealistic for teacher education institutions. An institution of higher education exists in a dynamic social setting. Environmental change can modify the nature of program costs and benefits. The State of Ohio, in mandating the redeisgn of teacher education, has made a significant modification in the environment. The uncertainty created in relation to the costs associated with the new program because of the State's action is an additional element of a cost-benefit analysis study (Maciariello, 1975). If a study examines a program a posteriori, then a static cost-benefit model is appropriate. A program that has already taken place will not change because of environmental modifications. (A change could occur if someone modified the information base of the program.) Uncertainty may not be needed in a static model. In a cost-benefit model designed to look at a future program, i.e., a priori, uncertainty must be considered. Both conditions exist in the cost-benefit study summarized in this paper.

Objectives

The following set of objectives has guided the progress of this study of two teacher education programs. One program is currently operating at Kent State University; the second program is projected in the plans that are developing in terms of the Standards for Colleges or Universities Preparing Teachers.

1. Describe in detail the two teacher education systems--current and proposed.

2. Operationalize the major components of a dynamic cost-benefit analysis study.

2. Design a cost analysis model for the two teacher education systems.

4. Design a computer program to process the data for each teacher education system.

5. Develop a cost figure for the current teacher education program at Kent State University.

6. Project a cost figure for the new program based on the Standards for Colleges or Universities Preparing Teachers.

7. Identify the cost ratio that will compare the costs of the two teacher education programs.

Method

The overall goal of this study has been the development of a cost-benefit model that will yield a cost-benefit ratio for two teacher education programs. One program is currently operating; the second is proposed. Three basic evaluation reserach methods have been used to achieve the goal of this study.

First, descriptive procedures have been employed to identify the cost characteristics of the programs. College catalogues, certification program requirement sheets, and departmental philosophies, just to mention a few, have served as sources of information on programs. The literature has been reviewed for further information on modeling for cost analysis purposes. Second, econometric procedures have been utilized to define basic concepts associated with costs. These concepts are the basis for designing the basic cost analysis model incorporating the factors discussed previously. Finally, computer programming procedures have provided the basis for processing the data associated with the model.

Results

The results of this cost analysis study using the objectives as a frame of reference can be divided into four sections: (1) the input structure that establishes the relationship between cost categories; (2) operationalizing time and uncertainty in the program; (3) estimating costs of the programs; and (4) the actual cost ratio. Every effort has been made to provide sufficient descriptive specificity to allow the results to be self-explanatory.

Input structure. Attaching definitional precision to costs has not been the simple task it might appear to be at first glance. The categories in a budget do not provide the helpful guide one might expect. Personnel costs may exist in several categories. Haller (1974) has suggested a four-category system for operationalizing costs. These are time, space, equipment, and supplies. Time costs concern expenditures for personnel. Building, utility, and grounds costs are included in space while transportation, desks, and laboratory materials are some of the equipment costs. Supply costs are identified with items such as paper and duplicating fluid. Haller's term "time" has been changed to personnel to ease communication. A fifth cost category has been added. These are spillover costs discussed previously (Judy, 1969). Personnel, space, equipment, supplies, and spillover are the five cost variables.

The framework for analysis with costs as one category can be expanded to include a second category which deals with the programmatic elements of teacher education based on the Standards. These include organization, curriculum, instruction, faculty, student services, facilities, and evaluation. Although

this researcher spent a great deal of time moving from the Standards to definitions with sufficient clarity to identify costs, a reader interested in more information should consult the Standards (1975) and a document sent to all teacher training institutions in Ohio titled Projected Compliance Costs for Teacher Education Redesign in Accordance with Subsidy 419. Finally, the third category in the framework places the variables in the program over time (Haller, 1974). Research and development costs across programmatic elements must be identified. These are followed by specifying the same factors related to implementation of the program. The third subcategory involves the actual operation or maintenance of the program. Each subcategory interacts with elements of the other categories (see Figure 1).

Time and uncertainty. The factors of time and uncertainty are critical in this study.* The cost data for the current program used the 1972-76 time period for evaluation purposes. The proposed program, on the other hand, will not be implemented fully until the 1980-84 period. As a result, the time factor becomes extremely important. It is not valid to simply compare costs in different time periods without explicitly making adjustments for time. There are two dimensions which need to be recognized; namely, the time value of money and inflation. The time variable recognizes that a dollar today is worth more than a dollar next year because current dollars may be invested. For example, if the current dollar is placed in a savings account paying 5 percent interest, then it grows to a $1.05 after one year, $1.102 after the second year, and $1.158 after three years. Conversely, one should be willing to accept a dollar today in lieu of the $1.158 in three years since the two amounts are equivalent assuming the current funds are invested at a yield of 5 percent. This relationship is called the present-value concept and permits a comparison of cash flows in different time periods. Specifically, the costs in the third year are discounted back to the present using the re-investment rate of 5 percent.

$$\frac{1.158}{(1.05)^3} = 1$$

or more generally:

$$PV = \frac{c_n}{(1 + k)^n}$$

where: c_n represents cost in year n

k is the discount rate used as a proxy for time (See Weston and Bringham, 1975)

A second dimension which compounds the problem is inflation. Similar costs in the 1980-84 period will be greater than in the 1972-76 period due to inflation. The cost analysis model developed in this study recognizes this factor. Traditional cost analysis models use the discount rate, k, to be:

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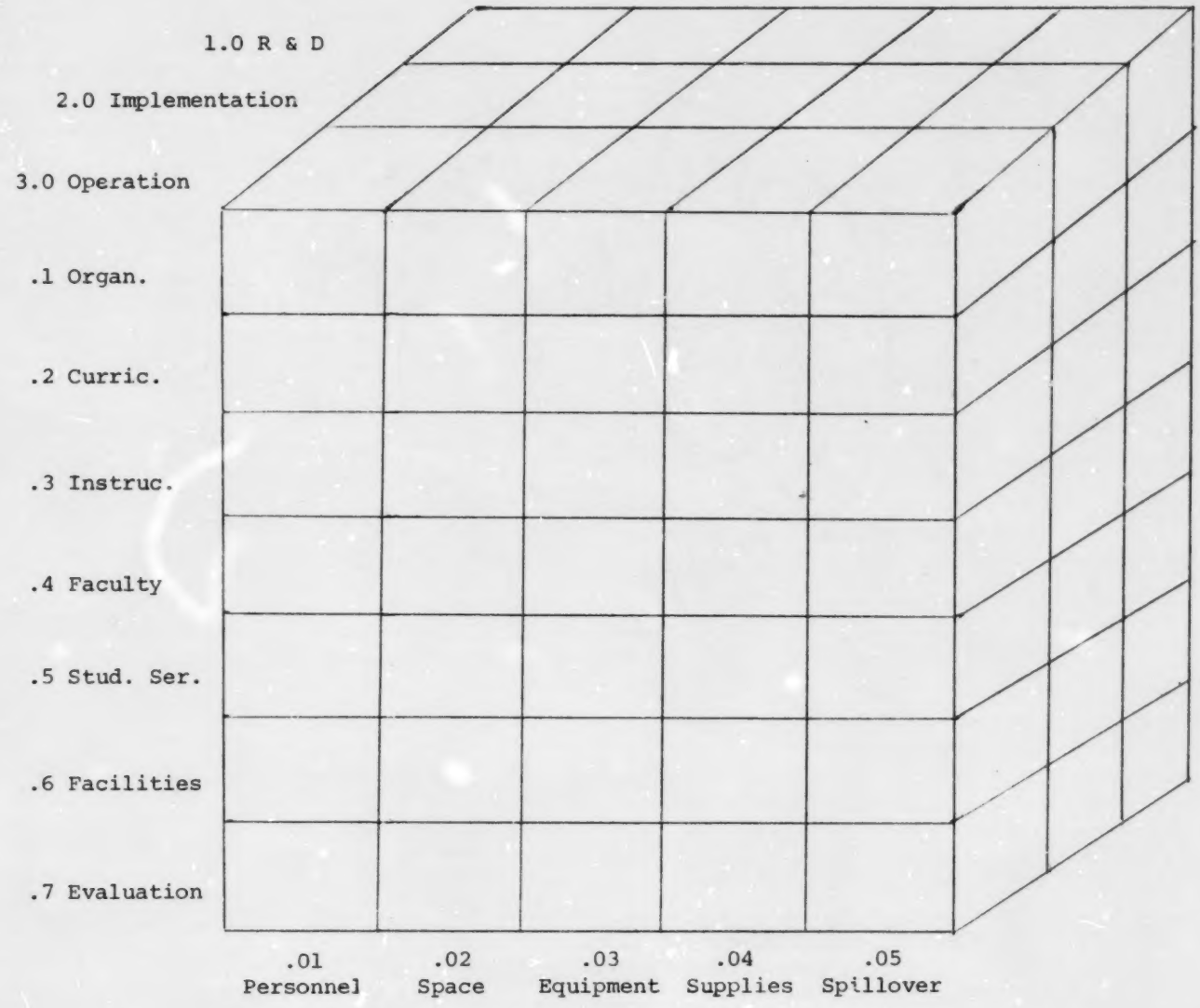
*This researcher extends his gratitude to Dr. J. D. Williams, project consultant, for his contribution to this portion of the report.

Figure 1

Framework for Analysis of Costs
Associated with Teacher Education



$$k = i + a + p$$

where: i = a proxy for time value of money (Yohe and Harnosky, 1969)

a = inflation rate

p = risk premium (Cooley, Roenfeldt, Chew, 1975)

One assumption of this approach is that the cost estimates in the numerator of the first equation must include anticipated inflation if the discount rate contains an element attributable to inflation (Van Horne, 1971). Ignoring this adjustment biases the results of a calculation. Cooley, Roenfeldt, and Chew (1975) have suggested that one way to adjust for both inflation and time value would be as follows:

$$PV = \sum_{t=1}^{n} \frac{c_t}{(1 + a)^t (1 + i + p)^t}$$

where: t = time period

c_t = money flow including estimated inflation adjustments

a = inflation rate

i = risk-free rate of return

p = risk premium to reflect uncertainty

This approach requires an estimate of i and a as well as the effect of a on cash flow.

In this study the decision was made to simplify the process by assuming both programs were in operation during the 1972-76 time period. This will remove the necessity of adjusting the costs (in the numerator) for inflation and specifically adjusting the discount rate to reflect both an inflation rate and a time value of money rate. Because of this decision, a portion of the time value problem has been eliminated. The model will still reflect the differences in time value of costs over the four-year period from 1972-76.

In addition, the costs can now be expressed in constant dollar terms and inflation need not explicitly be built into the model. In those situations where it is anticipated, the proposed teacher education program will incur more of a factor which is sensitive to inflationary pressures than the existing program. Appropriate adjustments were made when this happened, e.g., faculty salaries. By using a common time period for both programs, this study has minimized the problems inherent in cost analysis studies.

The second factor which was mentioned above related to the uncertainty or the risk premium variable (b). It is obvious that many of the cost factors in this study are estimates and contain various degrees of uncertainty. The model developed herein incorporates this uncertainty by examining the sensitivity of the cost ratio to changes in the cost assumption.

Actual program costs. With the defining of an input structure, time, and uncertainty, costs of the programs could be calculated. The appendix provides a sample of the format used to calculate costs for the teacher education programs. Using a technique described by Sax (1968) for randomly selecting subjects from an alphebatized list, a sample of ten Ss was drawn. They were selected from a list of graduates with certification in teacher education who completed their work in June, 1976. The random sample reflected the actual distribution of students across certification areas. A cost figure was determined for each student and then an average for all ten was calculated.

A more complex procedure was required to determine cost estimates for the program as it is designed to operate according to the Standards. Initially, it was necessary to identify those cost variables that might change at a greater or lesser rate than anticipated using an average percent per year increase in costs per variable. The present-value concept in relation to 3.4.1 in the appendix had to be adjusted. This process was called tagging. The 3.4.1 category, for example, was given an average plus 3 percent. Once the tagging was completed, cost estimates could be made for the new teacher education program.

Both programs require 420 repeat input steps in the calculation of costs. In addition, 145 summing process steps and 96 output steps were required. The computer program currently under development will make it possible to speed the calculations. A sample single sequence is given in Figure 2.

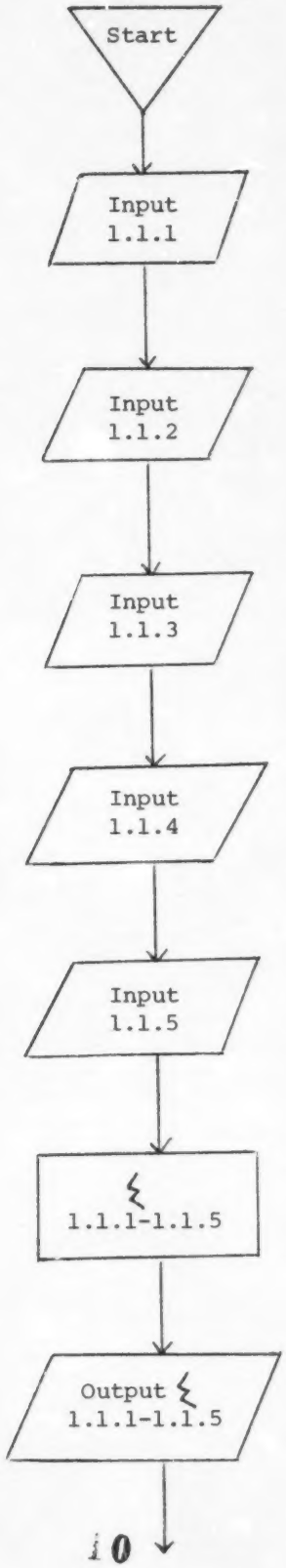
Cost ratio. The cost analysis study has made it possible to project a ratio of costs between the current teacher education program and the projected program that will be implemented in the fall of 1980. For every dollar across all cost categories expended during the period from 1972 through 1976, a total of $1.64 will be expended during the period from 1980 through 1984. The cost ratio has been adjusted for time and uncertainty. A number of sub-ratios have been calculated for the variables shown in Figure 1. It is important to consider the sub-ratios as the discussion on transportability of the model for cost analysis is presented in the next section of the paper.

Implications

One of the original purposes of this study was centered on defining the benefits of a teacher education program. The condition or state of teacher education in the 1970's does not provide sufficient evidence of the benefits given specific variations in the educational process. What difference will training in human relations make? How will performance be influenced by earlier field experiences in urban and suburban or rural schools? These and other questions must be answered quantitatively before specific cost figures can be calculated to conduct a cost-benefit analysis in teacher education. For the purpose of this study, a benefit was defined as a certified teacher.

Any institution of higher education in Ohio involved in teacher education could use the framework for cost analysis based on the Standards. The ability of an institution to use the model will depend on its own determination of costs. The actual ratio of costs will vary with every institution unless two schools are delivering services to identical populations in communities with identical demographic characteristics over identical geographic areas. This likelihood is remote. Individual institutions must tag the categories in

Figure 2


Start
Input
1.1.1
Input
1.1.2
Input
1.1.3
Input
1.1.4
Input
1.1.5
1.1.1-1.1.5
Output
1.1.1-1.1.5
i0

relation to their unique circumstances. Uncertainty will vary across institutions; priorities will be different. The model, however, should have state-wide applicability.

The major modification necessary in the model for use outside of the State of Ohio would be modifications in the input structure related to the programmatic variables. The applicability of the seven variables operationalized in the Standards and, subsequently, by institutions of higher education would depend on careful comparisons of programs.

Finally, the state of the art of cost-benefit analysis in teacher education has a great deal that it can use from the field of finance. The degree of sophistication regarding the analysis of costs and benefits is far beyond the information currently available through studies in education. Additional studies in teacher education incorporating constructs from finance may increase our ability to do cost-benefit analysis studies.

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Appendix

3.0 Operation		Year 1	Year 2	Year 3	Year 4
3.1 Organization					
3.1.1 Personnel	=				
3.1.2 Space	=				
3.1.3 Equipment	=				
3.1.4 Supplies	=				
3.1.5 Spillover	=				
3.2 Curriculum					
3.2.1 Personnel	=				
3.2.2 Space	=				
3.2.3 Equipment	=				
3.2.4 Supplies	=				
3.2.5 Spillover	=				
3.3 Instruction					
3.3.1 Personnel	=				
3.3.2 Space	=				
3.3.3 Equipment	=				
3.3.4 Supplies	=				
3.3.5 Spillover	=				
3.4 Faculty					
3.4.1 Personnel	=				
3.4.2 Space	=				
3.4.3 Equipment	=				
3.4.4 Supplies	=				
3.4.5 Spillover	=				
3.5 Student Services					
3.5.1 Personnel	=				
3.5.2 Space	=				
3.5.3 Equipment	=				
3.5.4 Supplies	=				
3.5.5 Spillover	=				
3.6 Facilities					
3.6.1 Personnel	=				
3.6.2 Space	=				
3.6.3 Equipment	=				
3.6.4 Supplies	=				
3.6.5 Spillover	=				
3.7 Evaluation					
3.7.1 Personnel	=				
3.7.2 Space	=				
3.7.3 Equipment	=				
3.7.4 Supplies	=				
3.7.5 Spillover	=				